The American Fertilizer

Vol. 92 MARCH 16, 1940 No. 6

Published every other Saturday. Annual subscription: In the United States, $3.00; Canada and Mexico, $4.00; other countries, $5.00. Entered as second-class matter, January 15, 1910, at the Post Office at Philadelphia, Pa., under Act of March 3, 1879. Registered in United States Patent Office. Publication office, 1330 Vine St., Phila., Pa.

See Page 25

...THE...

AMERICAN FERTILIZER

"That man is a benefactor to his race who makes two blades of grass to grow where but one grew before."

Vol. 92 MARCH 16, 1940 No. 6

Pastures for Horses*

By CHESTER F. HOCKLEY

President, The Davison Chemical Corporation, Baltimore, Maryland.

WHEN the first Englishmen landed in Jamestown in 1607 they could not be fully aware of the extent of the richness of the lands they were about to inherit. Here, undisturbed by axe or plough, Nature had, during countless centuries, built up a rich fertility in the soils such as was enjoyed nowhere else in the civilized world. Here, for the first time, these English pioneers were given a chance to realize economic independence. On this basis they in time established a new order of political liberty.

Let us consider the setting: Virgin forest stretched from the seaboard to the great prairie regions of the West. The rich, black meadows and prairie soils were a vast storehouse of plant food, slowly built up during the centuries in Nature's own laboratory with a system of grasses and buffaloes. Beyond the prairies came the great plains area, and beyond them rose the Rockies with their vast stores of minerals and timber. Soil, grass, timber and minerals—these are the essential capital of any nation, and on these the pioneer fathers built the solid foundations of our country.

Many of us for pleasure or business have travelled a lot over this land of ours—north, south, east and west. We have seen corn, cotton, tobacco and grains where once the forests stood. About one-half of the total area of the United States is in farms. Of this total farm area, one-half is in crops, and the other, about four hundred million acres, is in pastures, woodland and waste.

But of the once vast fertile areas of our country, about six hundred fifty thousand farms, comprising about one hundred million acres, today cannot raise crops at a profit. The virgin fertility of the colonial days was exploited and wasted in a manner hard to believe. Those early settlers had brought with them a knowledge of farming which was based on good husbandry. The farmers of Europe have always had to farm so as to conserve soil fertility. But when these same farmers saw before them the vast resources of this virgin continent, they apparently forgot the principles of good farming and forestry. When the land which at first produced such big crops of tobacco became impoverished through bad management, the farmer pulled up stakes and moved on to fresh acres. By the end of the 17th Century the problem of exhausted soil was already acute in Maryland and neighboring Virginia. What happened in our state was repeated, in time, in all states. Ruthless exploitation and waste of the richest lands in the world has been the history of three centuries of settlement. Today the whole nation is burdened with the social and economic consequences of that mismanagement of our natural soil resources.

A cartoon once appeared in one of our weeklies about people of today. It carried the words: "We are the posterity for whom our grandfathers prayed. . . . Can you blame them?" When I consider today's soil fertility problems and realize how our social and economic situation can be traced back to the abuses and mismanagement of the rich inheritance of our forefathers in this land, I often think of that cartoon and the double-meaning words of the cynical artist: "Can you blame them?"

Yet the problems, serious as they are, can be solved. One of the best ways to attack the problem is, in my humble opinion, to return to the wise principles of farm management which prevail in European countries today and which

* An address before the Maryland Stockmen's Association at their annual meeting in Baltimore, Md., January 10, 1940.

our pioneer fathers forsook. A return must be made to that system of farming which recognizes the value of livestock and the building up and maintenance of good pastures in the farm program.

Animals Thrive on Certain Soil Areas

It is well recognized among stockmen and breeders in particular that there are certain soil areas where livestock thrive better than in other parts of the country. We are all familiar with the manner in which grazing animals, and this is particularly true of horses, will crop too closely certain areas in a field and leave other parts of that same field practically untouched. Different sections of our country differ to the same degree. What makes some areas excel over other parts of the country? Is it climate? Soil? Sires? Or Man?

We can now answer definitely, it seems to me, that the outstanding reason why animals do so well in areas noted for producing the best livestock is because the grasses and other forage which grow there contain a sufficient amount of minerals and other nutrients so necessary to normal growth and health and vigor. In other sections, where animals do not do so well, the reason is found in the lower fertility level of the soil. Animals, in other words, will thrive where the pasture feed contains all essential nutrients, and will attain only that degree of health and vigor that is permitted them by the fertility level of any one of the essential nutrients. If phosphorus is deficient, for example, it will be the limiting factor.

This relationship between soil fertility and thriftiness of livestock is accepted today by science as well established by research. The idea, however, is not new. Over a century ago a Scotchman, William Aiton, published in Glasgow a book[1] in which he discussed the connection between soil and the well-being of cattle. He said, among other sound things:

"The soil, climate, and mode of feeding and treatment, so powerfully affect the size and qualities of cattle, that it becomes impossible to raise them above what these can support. Every soil is calculated to support cattle, of a weight and quality, suited to its fertility. When cattle are removed to a better soil, or when, by culture or other means, the soil, on which they are kept, is improved, a proportional improvement may be expected in the breed. But if cattle are removed to a soil greatly inferior to that on which they have been reared, they will degenerate and dwindle down to the size and qualities that the soil, on which they are fed, is capable of supporting."

Two other British authorities on livestock *a century ago* made similar observations. One, David Low[2] of Edinburgh University, stated:

"It is upon the supply of food that the size of the animals seems mainly to depend. Wherever food is supplied in abundance the ox becomes enlarged in bulk; and wherever food is deficient, whatever be the nature of the climate, his size becomes less."

The other authority,[3] a sheepman, writing in 1831 said, in discussing an anemia in sheep called "pining":

"On genuine pining farms sheep do not take it by ones or twos but a whole flock at once. . . . There is only one effective cure known in this country, which is a change of pasture to one of more succulent herbage. . . . If the sheep are laid on clover or limed ground, the cure is the quicker. . . . The pining is not infectious. . . . After dear experience I am convinced that it proceeds wholly from the food."

These old observers did not have the advantage of science and the nutritional laboratories which we of today are privileged to have. We now know they were right, and the only difference between them and ourselves is that we are more able to understand the why and wherefores underlying the conditions and consequently can do more to permanently correct them.

Livestock Need Minerals

We must accept the fact, then, that a soil lacking essential mineral nutrients cannot support vigorous, healthy animals because the forage growing on such soil cannot possibly have those elements. If they are not in the soil they will not be in the forage cropped on that soil. Fortunately, in our day, science has shown us how to make rapid chemical tests to determine what elements are contained in a soil and also in the herbage. Where it is determined that any elements are lacking we then know how to restore the deficient minerals by means of suitable fertilizers, phosphatic materials and lime; and how best to utilize those minerals by proper pasture management.

Phosphorus and lime are two elements essential in the nutrition of all animals. These two compose about three-fourths of the mineral matter of their bodies, and over nine-tenths of the mineral matter of the skeleton. These two

[1] Aiton, William, General View of the Agriculture of the County of Ayr. A Napier Trengate, Glasgow (1811).

[2] Low, David, The Domesticated Animals of the British Islands. Longman, Brown, Green and Longman, London (1842).

[3] Hogg, J., Remarks on Certain Diseases of Sheep, Quart. Jour. Agr. II, 697-706 (1831).

minerals make up more than half of the total mineral content of milk. Farms in the older agricultural areas are, of course, more apt to show phosphorus and lime deficiency. Our State Experiment Station reports[4] that phosphorus is deficient in practically every soil type in Maryland, and this is true of the whole Atlantic Slope.

The first essential in the improvement of pastures on all soils in Maryland—in fact, in all the northeastern states—is to provide an adequate supply of available phosphorus. This can be supplied most economically in the form of superphosphate and agricultural authorities seem to be recommending it now almost universally. In addition to this my belief in it is based on actual experience on my own farm.

Causes of Poor Pastures

It has been my observation that most of the pastures in Baltimore and Harford Counties comprise sloping lands which are subject to severe erosion. While some of these lands have fairly good sod, the majority, unfortunately, do not, and unless something is done to improve them they remain a serious problem in conserving soil fertility and in the prevention of soil erosion.

Yet these two counties and the neighboring counties of Howard, Carroll and Cecil, comprising the Piedmont soils, have the most favorable conditions for pasture in Maryland,[4] and we should capitalize on them.

State authorities in all the northeastern states have estimated that most of the untreated permanent pastures in this section require five to six acres to carry one animal unit. This is a low and profitless carrying capacity, and is due to the poor type and quality of herbage present. Kentucky bluegrass and white clover—the two best types of herbage for our local pastures—are present even on the better types of pasture to the extent of only about one-fourth to one-third of what they should be.[4] In their place we have weeds and poor native grasses that yield little nouishment for animals and make a thin sod subject to increasing erosion. Furthermore, exhaustive research in this section leads to the conclusion that, even under most favorable growing seasons, it is not possible to bring about improvement in these permanent pastures unless something positive is done to increase the mineral and humus content of the soils.

The evidence points clearly to two main causes for the large percentage of poor pastures: one, soil acidity; the other, depleted fertility. Having thus diagnosed the trouble we can suggest the remedy.

Lime is needed on practically all of our pastures, before Kentucky bluegrass and white clover can be re-established. Phosphorus is needed to an even greater degree on all pastures. Soil tests in every part of our state show this need, and it is not surprising when we consider the demand for these elements. Lime and phosphorus are the main components of the animal skeleton. One per cent of the weight of a mature horse is phosphorus and two per cent is calcium. Every can of milk, every animal sold off the farm, every ton of hay, represents a consumption of lime and phosphorus which comes out of the soil. Wheat and oats contain about seventy-five per cent of their total phosphorus in the grain. Every bushel of these grains sold means a loss of seventy-five per cent of the phosphorus they took out of the soil. What phosphorus a plant removes is that which is the best and most available portion in the soil.

Phosphorus consumption has been going on with no letup for at least two centuries, during which time only little, if any, fertility was returned to the soil. When we consider that some of the most fertile virgin soils have on the average not more than fifteen hundred pounds of available phosphorus to the plough-depth acre, it is not surprising that a serious deficiency of this mineral exists in our old soils. A good crop of corn—say seventeen barrels per acre—removes about fifteen pounds of phosphorus from the soil;[5] thus, the *total* amount of this element in virgin soils was enough for only one hundred crops of corn. When a farmer applies two hundred and fifty pounds of a 2-12-6 fertilizer to the acre of corn he is putting on only about thirteen pounds of phosphorus. This is short by about two pounds of what the crop uses in its growth. You cannot build up fertility reserves that way, and the depletion has been going on for two hundred years and at a greater rate of loss than these figures indicate, since during the first hundred years no chemical fertilizers were used and the only replacement was through the use of manure. The same depletion that occurs with corn occurs with other crops. With the possible exception of the farmer who grows truck crops, it is safe to say that most farmers take out of the soil more fertility than they replace by fertilizers and good soil management.

The amount of phosphorus lost by erosion is also a big drain on the supply. This loss is

[4] Grau, Fred V., Permanent Pastures in Maryland, Maryland Agri. Exp. Station, Bulletin No. 373 (1935).

[5] Pierre, W. H., Phosphorus Deficiency and Soil Fertility, U.S.D.A. Year Book (1938).

accentuated by row crops. Phosphorus is found in the very fine clay particles of the soil which are the particles most easily carried away by rain water. On land having a 3.7 per cent slope, it has been shown[5] that more phosphorus was *lost* by erosion in one year where corn was continuously grown than is contained in a twenty-barrel crop of corn (18 lbs.); where wheat was grown continuously the loss was 9.4 pounds; where a good rotation was practiced (corn, wheat, clover, hay) the loss was 6.2 pounds; and where continuous bluegrass sod was the cover the loss of phosphorus was only two-tenths of a pound.

Mineral Fertilization

I do not mean this to be a sales talk, but we cannot discuss pastures without referring to phosphorus, and we cannot discuss phosphorus without mentioning superphosphate. The cheapest form of phosphorus for the farmer is twenty per cent superphosphate, and it pays well to use about six hundred to eight hundred pounds per acre on the first application. On some of my pasture fields on a run-down farm I have applied fifteen hundred and two thousand pounds per acre, and after pasturing these fields two seasons at the rate of three animal units per acre, the soil tests showed that they were agin deficient in available phosphorus. However, this was after intensive grazing and the effect of the minerals was evident in the growth and condition of both horses and cattle.

Lime

Lime is of equal importance with phosphorus in the pasture program. I often wonder why it is that farmers in one state use it to advantage while farmers in other states of the same agricultural region fail to use it.[6] Kentucky in 1936 used the equivalent of 124 pounds of lime oxide per acre of cropland, while Maryland used 57.6 pounds; and Pennsylvania 46.5 pounds; New Jersey 75 pounds; West Virginia 18.6 pounds; New York 29 pounds. The need for lime in all these states is quite similar, but the farming practice varies. Kentucky breeders give great credit to their soil, but without the generous use of lime year in and year out their claims would not stand up. Over a hundred years ago Edmund Ruffin, a practical farmer in Virginia, was the first man we have any record of who tested soils chemically and who inferred that most of our soils were too acid and needed lime. Apparently it has taken us a hundred years to learn, but fortunately the attitude toward lime is changing.

[6] Truog, E., Putting Soil Science to Work, Jour. American Soc. Agron. Vol. 30, No. 12, p. 981.

Most of the pasture soils are acid and consequently have a higher power for rendering soluble phosphoric acid insoluble. I have found it desirable to apply finely powdered limestone at the rate of one to two tons per acre, depending on the soil test, several weeks prior to top dressings with superphosphate. This is important if one is to obtain the full benefits of the phosphorus. When applied as superphosphate, the phosphorus is in a soluble form, available as plantfood. Acid soils have the effect of rendering much of this available phosphorus insoluble, and hence of no value to the plant. This effect is known as "fixation" or locking up of the available phosphorus. By applying the limestone ahead of time a less acid or a more nearly neutral condition of the soil is created and this releases much more of the phosphorus for the use of the growing plants.

It is not good practice to apply lime and superphosphate at the same time because the lime is needed ahead of time to prepare the soil to maintain the availability of the phosphorus.

I have emphasized phosphorus and lime because they are the foundation for better bluegrass and white clover pastures. When you have a heavy sod of these grasses you can be assured of greatest returns from your permanent pastures.

Protein in Pasture

Cornell University reports[7] that our native wild white clover—not white Dutch clover—influences the yield and production of the pasture herbage. Their tests show that Kentucky bluegrass grown alone yielded 888 pounds of dry matter, whereas when wild white clover was grown with it, the yield was 4,985 pounds per acre. The clover also raised the protein content of the pasture grasses from eighteen per cent to thirty-one per cent. This increase, of course, was mostly due to the high protein content of the clover; however, the tests also show that the protein of the bluegrass was raised on an average of about twenty-five per cent. It was estimated from these tests that the herbage removed from one acre of good bluegrass-white clover pasture contained an amount of protein equivalent to the nitrogen in approximately twelve hundred pounds of sulphate of ammonia.

That, it seems to me, is one of the most economical ways to get digestible nutrients for livestock feeding.

[7] Johnstone-Wallace, D. B., The Influence of Wild White Clover on the Seasonal Production and Chemical Composition of Pasture Herbage, Fourth International Grassland Congress (1937).

(Continued on page 22)

Florida Agricultural Research Meeting

The fifth annual general educational meeting sponsored by the Florida Agricultural Research Institute, in cooperation with the Association, was held in Winter Haven, Fla., on March 5th with 150 persons in attendance. The program which was arranged by Frank L. Holland was divided into three parts dealing with pastures, citrus fruits, and vegetable and truck crops, respectively.

At the morning session, R. E. Blaser of the Experiment Station staff presented experimental results showing the effects of fertilizer on Florida pastures; H. R. Smalley and R. H. Lush, of The National Fertilizer Association staff, discussed briefly some pasture developments in other parts of the country, and "Green Acres" was shown.

Grove practices at the Station that affect citrus quality were discussed by Dr. A. F. Camp, G. B. Fehmerling, and Dr. B. R. Fudge of the Citrus Experiment Station staff, and the discussion was led by H. A. Thullbery, Production Manager of the Haines City Citrus Growers' Association. W. L'E. Barnett, Chairman of the Research Committee of the Citrus Growers organization, spoke on "Some Grower Slants," and practical aspects of soils work were discussed by Dr. Michael Peech of the Citrus Experiment Station staff and W. L. Tait, Production Manager of the International Fruit Corp.

At the afternoon session, "Cover Crops as an Indicator of Soil Condition" was discussed by George M. Bahrt of the U. S. Department of Agriculture, Orlando, Fla. The effects of the freeze on pest and disease control were discussed by W. L. Thompson and Dick Vorhees of the Citrus Experiment Station staff. W. F. Lawless, also of the Citrus Experiment Station staff, spoke on "Rootstock Varieties and Fertilizer as Affecting Cold Resistance"; and Dr. A. F. Camp gave a summary of freeze observations.

Vegetable pest control in various sections of Florida was discussed by Dr. G. D. Ruehle of the Sub-Tropical Station, Homestead, and by Dr. G. R. Townsend of the Belle Glade Experiment Station. It was pointed out at the meeting that trees that had been well fed and well cared for were injured less by the freeze than poorly fed and poorly cared for trees.

Doctor Camp stated that following a freeze there is always a tendency to try to bring the trees back by an application of nitrogen only. He warned against this, stating that the results were likely to be disappointing and urged that consideration be given to the use of complete fertilizers which in Florida must contain the minor as well as the major elements.

Most of the fertilizer companies selling in Florida were well represented. There were also present some twenty members of the staff of the Florida Experiment Stations and a considerable number of representatives of grove caretaking organizations, both cooperative and private.

REDUCTION IN MAINE RAIL RATES

The Interstate Commerce Commission has authorized the Boston and Maine Central Railroads to make drastic reductions in their less-than-carload rates between points in Maine, Massachusetts, and New Hampshire. The reductions ranging up to more than 50 per cent had been under suspension by the I. C. C. since last August when the carriers proposed the cuts to meet truck competition. The new rates will be uniformly 90 per cent of the present fourth class rates for all types of commodities moving in less-than-carload lots.

JANUARY EXPORTS AND IMPORTS

Exports of fertilizers and fertilizer materials during January totaled 56,600 long tons, valued at $1,102,605, which is 34 per cent below January, 1939, and 48 per cent below January, 1938. Shipments of phosphate rock were materially affected by war conditions and amounted to only 20,590 tons, compared with 68,797 tons in January, 1939. Exports of nitrogenous materials increased from 11,317 tons to 27,164 tons but potash exports dropped from 2,144 tons to only 724 tons.

The principal feature of the month's imports was the increase in potash receipts, which totaled 41,798 long tons, more than twice the tonnage of January, 1939. Of the month's potash imports, about 26,000 tons was muriate, 9,000 tons was 20% kainit, 3,000 tons of sulphate and 3,500 tons of sulphate of potash-magnesia. All of the muriate and kainit and most of the sulphate were reported as coming from France. The rest of the sulphate and the sulphate of potash-magnesia were brought from the Netherlands. Nitrogenous materials totaled 99,200 tons as compared with 114,210 tons in January, 1940.

N. F. A. WINS MID.-WEST FREIGHT RATE CASE

The Interstate Commerce Commission has issued a favorable decision in the several cases regarding rates on fertilizers and fertilizer materials within Central Freight Association territory, I. & S. 4522 and I. C. C. Docket 28063, with which were joined Michigan cases D-3184 and D-3194.

On December 20, 1937, the carload rail freight rates on fertilizers within C. F. A. territory were increased on the average 14.5 per cent, in spite of protests filed by the Traffic Committee of The National Fertilizer Association. Schedules filed to become effective September 1, 1938, proposed further to increase these rates 10 per cent. The Traffic Committee again protested and was successful in having these proposed rates suspended.

On July 9, 1938, the Traffic Committee filed a complaint in the name of the Association alleging the carload rates on fertilizers and fertilizer materials between points in C. F. A. territory were unreasonable. Intrastate rates in Ohio, Indiana, Illinois, and Michigan were also involved, and actions before the various state commissions were contested.

A subcommittee of the Traffic Committee under the efficient chairmanship of the late W. W. Manker, assisted by special commerce counsel, John T. Money, handled all of these cases. A number of the Traffic Committee members gave testimony and furnished data at the various hearings of these cases. Several state cooperatives intervened in the case, as also did E. Rauh & Sons Fertilizer Co. and The Smith Agricultural Chemical Co., both of which asked reparations.

The Commission in its report found (1) that the proposed rates were not justified and ordered the schedules canceled; (2) that the present rates are unreasonable to the extent they exceed the rates in effect December 19, 1937, increased 10 per cent; (3) that E. Rauh & Sons Fertilizer Co. and The Smith Agricultural Chemical Co. are entitled to reparations.

SODIUM NITRATE PRODUCTION TREND UPWARD IN CHILE

A rise in production at the large nitrate plants of Maria Elena and Pedro de Valdivia was reported for the month of January, 1940.

The Santa Laura plant in the Iquique district resumed production in January following a period of inactivity of about 10 years. The capacity of the plant is about 3,000 tons monthly and the number of employes is about 400.

Preparations have been made for reopening the Brac plant in the Iquique district which has also been inoperative for some years. It is expected to furnish employment for about 600 persons and will produce at the rate of 8,000 to 9,000 tons monthly. It employs the Shanks process.—American Consulate, Antofagasta.

NEW FERTILIZER FILMS

Two 16-mm. colored motion picture films have been completed by the Midwest Branch of the American Potash Institute, Inc. Copies of the films will be available soon for loan to fertilizer manufacturers and other interested parties.

One 1,400-ft. reel, "New Soils From Old," was made for the Department of Agronomy, University of Illinois, and depicts soil fertility studies at state experimental farms. The film stresses the benefits from a balanced soil fertility program using limestone, phosphates, and potash, and depicts disastrous effects of a lack of any one plant food.

Another 1,200-ft. film, "Fertilizers Improve Midwest Crops," is composed of scenes at fertilizer demonstrations in southern Illinois, Indiana, and Iowa. Many symptoms of plant food starvation and chemical tissues tests to confirm them are also shown.

There will be a limited number of copies available. Anyone desiring to use these films for meetings this spring, should schedule their requests with the American Potash Institute, Inc., Branch Office, Life Building, Lafayette, Ind., or with H. L. Garrard, 7748 S. Ridgeland Ave., Chicago.

BRAZIL BONE EXPORT PROHIBITIONS REVISED

The President of Brazil signed on February 14, 1940, a decree-law amending decree-law No. 1774 of November 16, 1939, by permitting the exportation of long or hard bones destined for industrial use, bone joints employed in the manufacture of glue or gelatine, and animal feedstuffs containing bone meal in which the proportion of phosphoric acid, expressed as tri-calcium phosphate, does not exceed 26 per cent. Shipments of animal feedstuffs containing a higher percentage of phosphoric acid, as well as miscellaneous bones, are also permitted in cases where the contract for their sale had been closed on or before November 16, 1939, the date of decree-law No. 1774.

February Tag Sales

Total tax tag sales in February in 17 states, according to reports by control officials to The National Fertilizer Association, amounted to 717,752 equivalent tons. This represented a gain of 4.8 per cent over February, 1939, but tonnage was sofewhat below the corresponding month of 1938 and 1937.

An 8 per cent increase over last year was reported by the South, reflecting larger tonnages in Virginia, the Carolinas, Georgia, Alabama, and Texas, which more than offset declines in the other six states. Missouri was the only one of the five Midwestern States to show an increase over February, 1939. The sharpest decline for the month in the area was in Indiana, where January sales had been abnormally large.

Aggregate sales in the first two months of the year were 3.6 per cent larger than in the same period of 1939, the result of a small rise in the South and a substantial gain in the Midwest. Increases over last year took place in six states in the South, with Georgia and Mississippi showing particularly large gains. The larger tonnage this year in the Midwest has been due largely to Indiana.

Total Sales in the 17 states in the first eight months of the fiscal year, from July through February, for the past four years have been:

1936-37.....2,166,000
1937-38.....2,120,000
1938-39.....2,043,000
1939-40.....2,116,000

Sales this year have been 3.6 per cent larger than a year ago (the same percentage increase as in January-February). They have been practically the same as two years ago and somewhat less than three years ago. Increases for the period over last year have been reported by ten states and decreases by seven.

The January-February figures in the table reflect corrections made for January. The January figure for South Carolina was originally reported to the Association as 15,145 tons, which was later corrected to 45,145 tons. Other corrections made in January figures were: Tennessee, from 20 to 100 tons and Oklahoma, from 1,362 to 1,662 tons.

FERTILIZER TAX TAG SALES*

(Compiled by The National Fertilizer Association)

	February				January-February			
	1940		1939	1938	1939-40		1938-39	1937-38
	Per Cent of 1939	Tons	Tons	Tons	Per Cent of 1939	Tons	Tons	Tons
SOUTH:								
Virginia†	103	54,161	52,512	52,005	96	88,234	91,519	100,069
N. Carolina	111	159,531	143,926	140,014	88	242,214	276,281	248,120
S. Carolina	109	100,970	92,775	110,146	101	146,115	145,211	173,944
Georgia	136	130,780	96,454	151,965	120	159,267	132,723	185,415
Florida†**	90	47,155	52,649	53,921	100	122,351	122,957	131,698
Alabama	122	80,200	65,950	74,100	112	113,800	101,900	106,200
Mississippi	71	32,888	46,625	28,076	133	87,338	65,775	48,981
Tennessee†	79	16,126	20,506	17,792	70	16,226	23,211	21,713
Arkansas‡	93	11,150	12,050	18,000	114	30,200	26,600	27,850
Louisiana†	82	22,336	27,250	28,055	93	44,486	48,050	51,188
Texas†	119	19,768	16,620	17,841	113	33,561	29,645	31,531
Oklahoma	71	1,191	1,679	1,940	73	2,853	3,929	4,650
Total South	108	676,256	628,996	693,855	102	1,086,645	1,067,801	1,131,359
MIDWEST:								
Indiana	57	16,669	29,394	31,013	164	58,794	35,813	35,038
Illinois	72	4,263	5,916	2,600	74	5,343	7,194	4,675
Kentucky	93	14,875	16,000	13,908	89	17,325	19,423	27,278
Missouri	132	5,189	3,934	8,417	141	7,218	5,110	10,693
Kansas	95	500	525	2,595	206	1,450	705	2,685
Total Midwest	74	41,496	55,769	58,533	132	90,130	68,245	80,369
Grand Total	105	717,752	684,765	752,388	104	1,176,775	1,136,046	1,211,728

* Monthly records of fertilizer tax tags are kept by state control officials and may be slightly larger or smaller than the actual sales of fertilizer. The figures indicate the equivalent number of short tons of fertilizer represented by the tax tags purchased and required by law to be attached to each bag of fertilizer sold in the various states.

† Cottonseed meal sold as fertilizer included.

‡ Excludes 9,950 tons of cottonseed meal for January-February combined, but no separation is available for the amount of meal used as fertilizer from that used as feed.

** Includes 10,610 tons of phosphatic and lime materials for January-February.

THE AMERICAN FERTILIZER
ESTABLISHED 1894
PUBLISHED EVERY OTHER SATURDAY BY WARE BROS. COMPANY
1330 VINE STREET, PHILADELPHIA, PA.

A MAGAZINE INTERNATIONAL IN SCOPE AND CIRCULATION
DEVOTED EXCLUSIVELY TO THE COMMERCIAL FERTILIZER
INDUSTRY AND ITS ALLIED INDUSTRIES
PIONEER JOURNAL OF THE FERTILIZER INDUSTRY

WARE BROS. COMPANY
PUBLISHERS
1330 VINE STREET PHILADELPHIA, PA.
A. A. WARE, EDITOR

ANNUAL SUBSCRIPTION RATES

U. S. and its possessions, also Cuba and Panama.....$3.00
Canada and Mexico..... 4.00
Other Foreign Countries..... 5.00
Single Copy..... .25
Back Numbers..... .50

Vol. 92 MARCH 16, 1940 No. 6

Principal Articles in This Issue

PAGE

PASTURES FOR HORSES 5

Florida Agricultural Research Meeting.... 9

N. F. A. Wins Mid-West Freight Rate Case 10

February Tag Sales 11

Peanut Fertilization 12

Indiana Fertilizers, 1939 14

FERTILIZER MATERIALS MARKET:

New York 15

Baltimore 15

Chicago 17

Tennessee Phosphate 18

Russian Phosphate Production Increased..20

Peanut Fertilization

On Thursday, March 7th, an all-day conference was held at Atlanta on the fertilization of peanuts. Agronomists representing Virginia, North Carolina, South Carolina, Georgia, Alabama, and Florida were present. Virginia was represented by E. T. Batten; North Carolina by Dr. E. R. Collins; South Carolina by Dr. W. R. Paden, W. B. Rogers, and R. L. Smith; Georgia by R. P. Bledsoe, S. A. Parham, and U. R. Gore; Florida by W. E. Stokes; and Alabama by Dr. J. W. Tidmore. Dr. J. L. Roberts, Associate in Botany, Purdue University, was invited to be present and report on his greenhouse experiments. Five members of the N. F. A. Plant Food Research Committee were present, namely, Dr. H. B. Siems, Chairman; David D. Long, Chairman of the Subcommittee of Peanut Fertilization; Dr. H. B. Mann; Dr. J. R. Taylor, Jr., and H. R. Smalley. Others present were: J. J. Moore and D. M. Berry, of The Southern Oil Co.; Floyd H. Crotzer, The Nitragin Co.; J. Cooper Morcock, Jr., The Barrett Co.; W. M. Hutchinson, Secretary, Cotton Seed Crushers Association of Georgia; F. H. Perner, Stauffer Chemical Co.; Ed Stevens, Dawson Oil Co.; and Dallas Spurlock, County Agricultural Agent, Dawson, Ga.

The meeting began at 9.30 A. M. and lasted until 5 in the afternoon. Reports were presented covering experimental work carried on during the past year in each of the states represented, suggestions for further work here were discussed in detail, and each of the experiment station agronomists present indicated the experiments that he would be able to carry on during the coming season. Every factor that might affect the use of fertilizers on peanuts was carefully considered, including inoculation with the right organisms, spraying or dusting to control insects and diseases, the use of minor plant foods in addition to nitrogen, phosphoric acid, and potash, and the use of lime and gypsum.

Rather definite recommendations are being made as to fertilizing peanuts in all of the states represented, but many conflicting and unsatisfactory results have been obtained in experiments conducted to date, and the agronomists are trying to improve their experimental technique in order to obtain a sounder basis for their recommendations.

At the close of the meeting, Prof. W. E. Stokes of Florida was elected permanent chairman of the group and it was voted to hold another conference about March 1, 1941.

FRENCH POTASH PRODUCTION AT HIGH LEVEL

Press reports appearing outside of France have stated that the French potash mines are too near the Maginot Line to permit continuing commercial exploitation at present, and have indicated that such shipments as are being made are being drawn from stocks which existed at the outbreak of hostilities.

While no monthly statistics have been published on mineral production in France since August, 1939, it is understood in informed trade circles that, although there very probably was a slowing-up in output during the early period of reorganization following mobilization, production in the French potash mines has recovered rapidly and at present the output is close to maximum levels.

The latest officially published statistics of production were for the month of August, when the output totaled 45,000 tons of pure potash, as compared with 26,800 tons in the corresponding month of 1938. For the eight months of 1939, the total production in terms of pure potash amounted to 428,100 tons as compared with 382,700 in the corresponding period of 1938, and with 581,800 for the whole year of 1938. The output of 1938 represents a maximum tonnage in the years for which official production statistics are available—Office of the American Commercial Attache, Paris.

"TOO-MANY" FAMILIES ON "TOO-SMALL" FARMS

Since 1860 the number of farms in this country has more than tripled. But the size of the average farm has steadily decreased; as population grew, farms were subdivided. In 1880, according to census figures and estimates compiled by the Farm Security Administration, about 10 per cent of the country's farms were of less than 20 acres, but today, 18 per cent are of less than 20 acres. In 1880 nearly 30 per cent of the farms were less than 50 acres in size. Today, nearly 40 per cent are less than 50 acres.

The problem of the too-small farm has been intensified in recent years. It was less serious as long as the expansion of industry continued to absorb millions of people from farms. But with a shortage of jobs in the cities, beginning with the 1929 depression, too many farm people, who would ordinarily have migrated to urban areas, have had to remain in rural areas.

Meanwhile the productivity of milions of acres of farm land has been impaired by erosion and wasteful farming; drought has routed many families from their land. Areas still being cultivated are too poor to support adequately the present population, much less a growing population. Mechanization has displaced many former hired hands from the rich lands who, if they are going to continue farming, must add to the millions competing for and subdividing the remaining small farms in poorer areas.

PERUVIAN GUANO PRODUCTION ESTIMATED

Preliminary estimates of guano gatherings from the islands during the fiscal year to end in April, 1940, place the total at about 152,000 tons, or some 16,000 less than collections in 1938, which was a record for recent years. The less-satisfactory result was attributed by the Administration to the warmer weather and ocean water during 1939, which apparently curtailed the food supply of the birds. After filling the domestic requirements, as required by law, 15,000 tons were available for export. Of this amount, 10,000 were shipped to England and 5,000 to the United States. It is expected that guano production will be further reduced during the 1940-41 season.

The Guano Administration is conducting a scientific study of bird life and habits with the object of increasing guano output. During the latter part of December an aerial photographic survey of the guano islands was completed, from which an estimate of the bird population will be made.

NITRATE OF SODA DEPOSIT IN ARIZONA

It is reported that a deposit of nitrate of soda has been discovered near Safford, Arizona. Samples sent to the Arizona Bureau of Mines by the discoverers, W. Carter, C. McEuen and V. McBride, were analyzed and showed a high grade of sodium nitrate. It is claimed that the deposit contains a considerable tonnage of both low and high grade material.

NEW FERTILIZER HOUSE ORGAN

The first issue of "Fetheredge Quills" has recently made its appearance. This new house organ, written and edited by the employees of the Etheredge Guano Company, Augusta, Ga., is an interesting, gossipy addition to fertilizer journalism. It should prove a valuable sales-booster. The editorial on home-mixing, entitled "Synthetic Sympathy" is particularly to the point.

GEORGIA POWER CO. TO SELL LINK-BELT STOKERS

Link-Belt Company, Stoker Division, Chicago, announces the appointment of the Georgia Power Company, Atlanta, Georgia, as retail dealers in the sale of Link-Belt stokers in that territory.

The merchandising organization of the Georgia Power Company is under the direction of Mr. O. M. Jackson, who is recognized as one of the leading utility sales managers in the United States. Engineering, installation and servicing will be handled by the Link-Belt stoker distributor in Atlanta, the Campbell Coal Company.

The Link-Belt stoker was selected by the Georgia Power Company for exclusive representation, after investigation of various makes of stokers.

The advent of electrical utilities into the stoker merchandising field represents another step in the promotion of automatic firing with coal.

Indiana Fertilizers, 1939

The use of fertilizers in Indiana during 1939 was curtailed about 8.8 per cent from that of the preceding year, according to figures compiled by H. R. Kraybill, State Chemist and Seed Commissioner. The total output amounted to 201,420 tons in 1939, as compared with 220,967 tons in 1938 and 226,887 tons in 1937.

Of the tonnage reported, about 55 per cent was used in the spring and about 45 per cent in the fall.

The 2-12-6 mixture again proved to be the favorite, 88,350 tons being sold during 1939 or 52 per cent of the entire output of mixed fertilizers. Only one other grade sold more than 10,000 tons, namely, 0-14-6, with 11,836 tons.

The move for fewer grades of mixed fertilizers suffered a set back during 1939, as manufacturers registered 126 different analyses, compared with 115 the year before. How unnecessary the great majority of these grades proved to be, is indicated by the sales figures. Only 2 grades sold more than 10,000 tons each, only 18 grades sold more than 1,000 tons each, while 102 grades had sales of less than 500 tons each and 71 of these were produced in amounts of less than 100 tons each.

Summary

	1939	1938
Total tons reported	192,507	200,999
Tag sales from firms not reporting	8,913	19,968
Total tonnage based on reports	201,420	220,967
Total tonnage from tag sales	263,145	235,288
Raw Materials	21,099	21,064
Phosphate and Potash Mixtures	41,902	40,538
Nitrogen and Phosphate Mixtures	31	51
Complete Fertilizers	128,728	138,571
Miscellaneous	747	775

Leading Mixtures (Over 500 Tons)

	1939	1938
2-12-6	88,350	93,777
0-14-6	11,836	8,016
0-12-12	9,638	13,995
0-10-10	7,122	7,161
0-8-24	5,053	4,637
2-12-2	4,980	6,538
3-12-12	4,649	4,250
2-8-16	4,421	4,940
4-24-12	4,368	5,391
0-20-20	4,183	3,186
2-12-12	2,592	1,907
3-18-9	2,458	2,878
2-16-8	1,953	1,583
2-8-10	1,937	2,447
3-9-18	1,427	1,329
1-11-5	1,254	1,578
0-21-9	1,186	794
0-10-20	1,134	563
2-14-4	822	1,275
2-12-20	735	....
4-8-6	707	770
3-8-6	550	310
4-10-6	526	466
3-10-6	505	480

FERTILIZER MATERIALS MARKET

NEW YORK

No Increase in Sales. Movement of Nitrate of Soda Improving Slowly. Sulphate of Ammonia Continues Scarce with Export Demand Continuing.

Exclusive Correspondence to "The American Fertilizer."

NEW YORK, March 14, 1940.

There has been no increase in the sales of raw materials during the last few weeks, but manufacturers of fertilizers have apparently started to order some of their nitrate of soda requirements. However, the movement of this material has been rather slow and it will probably be another month or so before any large shipments are made. At such time it is expected that other raw materials for the fertilizer trade will start to move in fair volume.

Nitrate of Soda

Price unchanged and schedule of $27.00 in bulk and $29.00 in 100-lb. bags port basis prevails.

Sulphate of Ammonia

This material has become extremely scarce and domestic fertilizer manufacturers who are in need for same for quick delivery are finding it difficult to obtain. The export demand remains heavy and some sales have been made on small quantities at $36.00 f.a.s. England is exporting sulphate of ammonia to her own colonies and some of the inquiries in this market for British possessions are probably an attempt to obtain bargain lots.

Castor Pomace

There have been offerings of this material both from South America and Australia but only in comparatively small quantities but the asking price is considerably above the $17.50 price for domestic. It is also higher than the nominal asking price for European material.

Nitrogenous Material

There has been no change in this market, with foreign leather meal still being offered for shipment at $2.45 ($2.98 per unit N) and domestic manufacturers offering material at $2.50 ($3.04 per unit N) at ports.

Triple Superphosphate

There have been increasing inquiries for this material for export but from all indications there will be very little available except for domestic consumption.

Superphosphate

The price for domestic consumption in various part of the country remains unchanged, $8.50 per ton for run-of-pile; the price for export varies from $12.00 to $15.00 per ton f.a.s., depending on quality and packing desired.

Potash

This market continues quiet with price firm at 53½ cents per unit K_2O in bulk basis ex vessel.

Fish Scrap

Japanese sardine meal market has firmed somewhat and is steady today at $52.00 per ton for shipment.

Precipitated Bone Phosphate
(Fertilizer Grade)

Stocks of this material are very small in this country with foreign material offered for shipment at about $45.00 per ton of 2,000 lb.

BALTIMORE

Slow Start to Spring Shipping Season. Fill-in Material Orders Not Expected Until Later. Sulphate of Ammonia Scarce.

Exclusive Correspondence to "The American Fertilizer."

BALTIMORE, March 13, 1940.

The spring fertilizer shipping season is getting off to a slow start, with the result that manufacturers' warehouses are crowded to capacity, and until an appreciable quantity moves, there is not likely to be much interest shown in further supplies of raw materials.

The market is, therefore, dormant and without any import changes.

Ammoniates.—The market on ground animal tankage for feeding purposes is nominally $4.00 per unit of nitrogen and 10 cents per unit of B. P. L., f.o.b. Baltimore, which takes it entirely out of the class of fertilizer material.

Nitrogenous Material.—The market on this article is duller than usual at this time of the year. There is practically no buying interest being shown, and nominal quotation remains unchanged at $3.10 per unit of nitrogen with prospects that this might be shaded to $3.00 on firm bid.

Sulphate of Ammonia.—There is practically no activity in this material, although stocks are getting scarce, with mills running somewhat behind in their shipping schedule. It is significant that no resale sulphate is being offered on the market for domestic consumption. The nominal market is still represented by schedule of first hands which has not been changed from $28.00 per ton of 2,000 lb., in bulk, but as far as can be learned no new business can be booked on this basis. This material will probably continue scarce during the next 60 days.

Nitrate of Soda.—During the past two weeks deliveries have picked up considerably and will probably continue to increase as the season progresses. The market on both the imported and domestic brands is unchanged at $29.00 per ton of 2,000 lb., in 100-lb. bags, f.o.b. port warehouses, with usual differential for 200-lb. bags and in bulk.

Fish Meal.—With the approach of warmer weather, it is anticipated that there will be a slackening in the demand, with consequent lower prices after the peak season is over. The market remains at $58.00 per ton of 2,000 lb., in bags, f.o.b. Baltimore, guaranteed 55 per cent protein, and it is reported there are no heavy stocks being carried.

Superphosphate.—There is no change in the position of the market on this material which is ruling firm at $8.50 per ton of 2,000 lb., basis 16 per cent for run-of-pile, and $9.00 for flat 16 per cent grade, both in bulk, f.o.b. Baltimore.

Potash.—There is no activity in this material at all, and it seems that stocks in the hands of manufacturers and being in warehouses by manufacturers will be ample for the current season's business.

Bone Meal.—As practically all manufacturers have covered for their requirements of both raw and steamed bone meal, there is very little new business passing and all quotations are, therefore, strictly nominal. 3 and 50 per cent domestic steamed bone meal ranges in price from $32.00 to $36.00 per ton, according to quality, while 4½ and 47 per cent raw bone meal is quoted at $30.00 to $32.00 per ton, c.i.f. Baltimore.

Bags.—The burlap market continues to ease off, and the present market on plain, new, 10-oz. bags for spring delivery is about $110.00 per thousand, basis 40 cut 54 in., delivered Baltimore.

CHICAGO

Spring Business in Fertilizer Organics Beginning to Improve. Feed Materials Show Declines in Some Lines.

Exclusive Correspondence to "The American Fertilizer."

CHICAGO, March 11, 1940.

Some signs of interest in the organic market are now in evidence and a few trades have been booked. This renewed activity, according to sellers, will probably continue through the season. In the meantime the market has sagged somewhat, but no particularly undue selling pressure is noticeable.

Notwithstanding some feed producers claiming an improved consuming demand, the list

price of digester tankage has again been reduced; this time to $45.00 per ton.

Nominal prices are as follows: High-grade ground fertilizer tankage, $2.55 to $2.75 ($3.10 to $3.34½ per unit N) and 10 cents; standard grades crushed feeding tankage, $3.00 to $3.15 ($3.64½ to $3.83 per unit N) and 10 cents; blood, $3.10 to $3.15 ($3.77 to $3.83 per unit N); dry rendered tankage 67 to 72 cents per unit of protein, Chicago basis.

TENNESSEE PHOSPHATE

Early Spring Expected. All Branches of Phosphate Industry Preparing for Heavy Spring Business. Two Phosphate Pioneers Die.

Exclusive Correspondence to "The American Fertilizer."

COLUMBIA, TENN., March 11, 1940.

In spite of the occasional snowfalls, ice coatings and cold rains that continue in evidence, it becomes more and more manifest that we are justified in expecting an earlier spring than usual.

Both the large electric furnace plants producing elemental phosphorus are entirely in readiness for resumption of full capacity operation with return of the TVA season for being able to provide cheap secondary power and all signs indicate that by April 1st, both will be on a full capacity schedule again.

Mining, preparation and shipping are under full blast at all the phosphate rock producing plants with expectation of full shipping schedules as a corollary of what looks now like a heavy fertilizer-using year by farmers everywhere and in all lines.

General business activity throughout the phosphate region reflects the favorable effect of activity in phosphate industry and its collateral operations with simultaneous hopeful feeling and consequent activity of agricultural interests. Neither of these two great supporters of the Tennessee counties in the valleys of the Tennessee, Duck, Harpeth and Cumberland Rivers can alone suffice, but when both activities come together, all industries hum and "business is good" signs stick out all over the country.

One of the early pioneers in the phosphate business at Mt. Pleasant, widely known to the phosphate and fertilizer industry of the past forty-four years, Granbery Jackson of Nashville, Tennessee, passed away last week in his 67th year. Mr. Jackson had suffered a paralytic stroke several years ago, from which he had never recovered his faculties. He was associated with his brother, C. S. Jackson, in the old Jackson Phosphate Co., was for a while Chief Engineer of the International Agricultural Corporation, and head of the Natural Phosphate Co. Another well-known figure in phosphate circles, Edmund Hughes, former Postmaster and owner of large tracts of blue rock, died recently in his 85th year.

CITRUS FRUITS PRODUCTION LOWER

The total United States orange crop for the 1939-40 season is now indicated to be 70,392,000 boxes, compared with last year's (1938-39) record crop of 78,863,000 boxes, and the 1937-38 production of 74,785,000 boxes. Freeze damage to Florida Valencias now appears to be more severe than was previously indicated, and prospective production is now 22 per cent less than the February 1 estimate. Total production of all oranges in California is expected to be about 4 per cent larger than was indicated a month ago. Grapefruit production for the current marketing season is estimated at 30,800,000 boxes, compared with last season's (1938-39) record production of 43,714,000, and the 1937-38 crop of 31,093,000 boxes. The 1939-40 lemon crop in California is placed at 11,100,000 boxes, compared with 11,322,000 boxes last season

Russian Phosphate Production Increased

The output of apatite at Chibinogorsk has been considerably increased and it is reported in Germany that ore production approximates 10,000 metric tons daily. The ore is processed in concentrated plants for obtaining apatite and mephaline. Production technique was improved in 1939 by the installation of advanced processes. Among other improvements, so-called red apatite, which formerly was a production residue, is now processed. A new process for utilizing moraine mineral is now being tried out. It is stated that the production and processing of the apatite is now completely mechanized and that the ore-dressing work up to 90 per cent mechanized.

Plans have been drawn up for starting construction of a new large apatite mine at the Jukspoor mountain in 1940. The mine will require the construction into the mountain of two tunnels of 2 kilometers in length. Plans also call for starting production of two new units in the Chibinogorsk apatite works.

Apatite constitutes one of the principal raw materials that Germany will call upon Soviet Russia to supply upon a greatly increased scale as part of the projected economic collaboration between the two countries. Aside from its very insufficient domestic production of basic phosphate slag, Germany is dependent upon foreign sources for its requirements of crude phosphate, imported chiefly from overseas in the form of phosphate rock. Soviet Russia has participated in the German phosphate market to varying degrees in recent years but Soviet deliveries in general have furnished only a restricted share of the German requirements, supplied mainly by the United States and Northern Africa.

Even before the outbreak of the war, Germany for sometime had been encountering difficulty in procuring adequate supplies of crude phosphate, due to shortages of foreign exchange. In most recent times, insufficient supplies of sulfuric acid have also been an adverse factor in reducing production of superphosphate, principal phosphate fertilizer carrier.

Because of insufficient application of phosphatic fertilizers over a period of years, coupled with more intensive crop cultivation, German soil has been suffering from a great deficiency of phosphate, conducive to poor crop results. It would appear that Soviet Russia offers the only source available to Germany during existing war conditions for this fertilizer material, adequate supplies of which are recognized as indispensable for maintaining the nation's agricultural production.—American Consulate General, Frankfort-on-Main.

SHADE TREE EXPERTS TO MEET IN DETROIT

The 16th National Shade Tree Conference will be held this year on August 27th to 30th at the Book-Cadillac Hotel, Detroit. This conference is the outgrowth of a meeting called by the Connecticut Tree Protection Board in 1924 at Stanford, Conn. This year's program includes discussions on technical and scientific problems in the science of tree preservation and growth and will be accompanied by trade and educational exhibits, as well as field demonstrations. Information on the program can be obtained from D. F. Hayman, 710 Stephenson Bldg., Detroit.

NEW FERTILIZER COMPANY

The plant of the Piedmont Fertilizer Company, Charlotte, N. C., started operations on March 1st. This company was organized by J. Thurton Kiser on a semi-cooperative plan with large dealers in the area as stockholders.

MODERN HIGH-GRADE FERTILIZERS CAUSE LESS "SALT INJURY" than old-fashioned low-grade mixtures

WHITE AND ROSS, U. S. Department of Agriculture, in a recent article (Journal of Agricultural Research, **59**, 81-100)* point out that a high concentration of soluble salts near seedlings causes fertilizer injury. This has recently been emphasized by Hester (American Fertilizer, Vol. 91, No. 5).

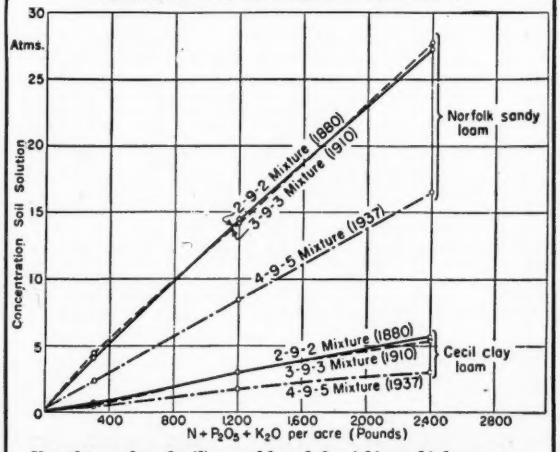
Fertilizer injury may be avoided by:

1—Proper placement.

2—Formulating fertilizers to give low salt concentration.

In their investigations, White and Ross determined the influence of equivalent quantities of different sources of nitrogen, phosphoric acid, and potash on the salt content of the soil solution. Their data show that some sources of nitrogen and potash increase the salt content of the soil solution more than six times as much as other sources of nitrogen and potash. Phosphates produce only slight increases in salt concentration.

Relative Influence of Typical Fertilizers As Formulated in 1880, 1910, and 1937 on Salt Content of Soil Solution of Two Soils



Note that modern fertilizers, although furnishing a higher proportion of nitrogen and potash, increase the salt content of the soil solution only 60% as much as old-fashioned fertilizers.

The investigators indicate that the relatively low salt effect of modern fertilizers, as shown in accompanying diagram, is due to:

1. **Increased plant food content of the mixture whereby less fertilizer has to be applied per acre.**
2. **Replacement of kainit and other low-grade potash salts with high-grade muriate, and**
3. **Substitution in part of free ammonia for other soluble materials.** **A reprint will be sent on request.*

DU PONT ON THE AIR—Listen to "The Cavalcade of America" every Tuesday, 9 p. m. E. S. T., over National Broadcasting Company Networks.

E. I. du Pont de Nemours & Co. (Inc.), Ammonia Dept., Wilmington, Del.

USE OF "URAMON"* FERTILIZER COMPOUND AND UREA-AMMONIA LIQUORS IN YOUR FORMULAS IS A STEP TOWARD LOWER SALT CONCENTRATIONS

*REG. U. S. PAT. OFF.

PASTURES FOR HORSES

(Continued from page 8)

Results at Beltsville, Maryland, in West Virginia, in New Jersey and Ohio, and in fact in every state in this northeastern region, emphasize the same thing: lime and phosphorus increase desirable grasses and legumes, decrease weeds and poor native grasses, and increase the percentage of protein and minerals in the herbage. They permit a larger carrying capacity on the same acreage; one to two cows per acre on improved pastures instead of one animal unit on five acres, and undernourished at that. The Pennsylvania Experiment Station reports:[8] "A well fertilized bluegrass pasture is capable of furnishing three times the digestible crude protein supplied by a four-year rotation of corn, oats, wheat and grass. An equal area of bluegrass pasture is capable of producing more total digestible nutrients than is produced by a grain rotation on the same soil."

Other Minerals: Manganese, Copper

Other minerals may be required on your pastures. Soil analysis should always be used to determine what these may be. Many pastures will need potash in the early stages of the improvement program. When needed it can be applied alone in the form of muriate of potash, or with superphosphate.

In the case of horse pastures, it is quite probable that manganese and copper, and perhaps boron, are also needed, and when supplied in suitable quantities, as determined by the soil test, will prove highly beneficial. Manganese is applied as manganese sulphate; copper is applied as copper sulphate. Both are applied at the rate of seventy-five pounds per ton of fertilizer and will probably produce improved results in the growth of young horses which will well justify the cost of these minerals.

The Kentucky experiment station, reporting[9] on the chemical analysis of their soils to which I referred above, says: "Manganese is an essential element for the growth of plants. . . . . Kentucky bluegrass is particularly rich in manganese and affords an interesting example of the function manganese has in the development of the beautiful deep green color which is a characteristic property of the luxuriant bluegrass pastures. . . .

"The occurrence of copper in Kentucky bluegrass and in other substances which are rich in the vitamin A factor suggest the possibility of an important biological function for this element in the normal processes of growth and development in plants and animals. . . . The soils of the Bluegrass Region and the Trenton area in Kentucky are richer in copper, manganese, zinc, nickel and cobalt than the soils of other parts of the State."

Nitrogen is also very important in the pasture program. However, it is my observation that if we provide generously the mineral nutrients already stressed, clovers and other legumes will be stimulated and these will provide the nitrogen required. Where pastures have been so neglected that no wild white clover is present, it will be necessary to sow one pound of seed per acre early in March and to apply a complete fertilizer prior to the seeding.

Manure can be used to advantage on very poor pastures whose thin soils are low in organic matter and where erosion possibility prevents seeding with green cover crops. Manure however, is low in phosphorus but valuable for its organic content, and when supplemented with twenty per cent superphosphate has been used with excellent results, applied at about eight tons per acre in the fall. The manured fields are grazed the following spring and mowed as closely as possible in May; clipping the grass at this time permits the white clover to come through and get well established.

Grazing

A cow or steer is said to consume about a hundred to a hundred and fifty pounds of green pasture herbage a day.[10] It is estimated that a horse will consume about eighty pounds of pasture herbage per day. Cows spend only about one-third of their time grazing; the other two-thirds they spend in lying down or under the shade chasing flies. To be able to eat a hundred and fifty pounds of herbage in eight hours re-

[8] Pennsylvania Experiment Station Bulletin 195 (1925).

[9] Dinsmore, Wayne, Leaflet 182, Horse Association of America (1927).

[10] Johnstone-Wallace, D. B., Pasture Improvement and Management, Cornell Ext. Bulletin No. 393 (1938).

quires that the animal must have a dense sod whose herbage is not taller than four to six inches. A cow's muzzle is only about three inches wide, and this three-inch mower must really work to cut off one hundred and fifty pounds of herbage in eight hours. Grass over five inches high is a hindrance and lacks nourishment. Young, short grass contains more nourishment, is much more palatable, and permits an animal to eat more in a unit of time. Thus on well managed pastures the mowing machine covers the field from three to six times a season, depending upon the condition of pasture and the amount of rainfall.

Grazing should not be started too early in the spring, or when the ground is still soft, as damage will be done to the young grass and the soft soil will puddle.

A system of alternate grazing of fields should be adopted, and each farm must work this out to suit its own needs and conditions.

Streamlining Cattle

Streamlining is a much over-worked word these days. It is applied to anything and everything. Sometime ago while talking with a friend from the far South I was amused when he applied it to the cattle in his state: "What I would like to know," he said, "is how we can streamline our local, native cattle." You probably know what he was referring to. It is pertinent to our present discussion. The cattle in many parts of the far South have to feed on grasses and weeds of such low mineral and protein content that they literally are forced to eat several times as much of the poor stuff as a cow on good pasture in order to get the same amount of mineral nutrients. It isn't any wonder that they worry about their cattle being pot-bellied. Yes, I told my Southern friend, the way to streamline his cattle was to lime and superphosphate their pastures.

Even a Blind Horse Can Tell

In the feeding of livestock, we are concerned not only with how *much* grass and legume herbage is present but, of more importance, with its chemical composition, its digestibility and its palatability. The cow and the horse know more about pastures than many of us farmers—they eat the pasture, the farmer does not. Dr. Dodd of the Ohio experiment station is credited with the story of a blind horse that was turned out to graze on two different demonstration plots placed side by side.[11] One plot was limed and phosphated; the other was not. The old blind mare grazed right up to the limit of the fertilized plot, moved along, took a nibble of the grass on the unfertilized plot, then turned right around and resumed grazing on the treated plot. Even a blind horse can tell the difference.

The difference in quality of pasture herbage can be definitely shown by chemical tests. The analyses from many agricultural stations show the phosphorus content of a given grass as low as one-tenth of one per cent, and under more favorable conditions the same grass will run as high as seven-tenths of one per cent. In such extremes, a cow (for example, those Southern cattle just referred to) would have to eat seven times as much herbage in the one case as in the other in order to get an equivalent amount of phosphorus. In the same way, the lime content may vary from two-tenths of one per cent to two per cent; and the protein content may range from three per cent up to thirty per cent. With such low nutrient levels even Southern cattle cannot stretch their stomachs sufficiently to hold all the roughage necessary to supply their normal requirements.

While my remarks have covered generally many features about which much is being written today, they are based upon my own experience with Thoroughbred horses and beef cattle on my farm in Baltimore County.

When I bought the farm, the land was badly run down. Soil tests revealed a very acid soil which in many fields had been depleted of practically all fertility. It was deficient in calcium, phosphorus, potassium, magnesium and other minerals, and much of it was low in organic matter. Bad soil management over a long period of years had exhausted the land's original fertility.

Much of the farm is rolling land, but the type of the soil was such that I was sure that with a good fertilizer program, plus grazing manage-

[11] Dodd, D. R., The Fertilizer Review, Vol. 14, No. 5, p. 3.

ment such as I have briefly sketched previously, those rolling hills could be transformed into first class permanent pastures. While three years is too short a time to accomplish that purpose, the results this fall have fully justified my expectations. If you will pardon the personal reference I would like to recite one or two of those experiences.

This past season I pastured a herd of late yearling Hereford steers on this farm. The average initial weight when they were first turned into pasture on April 25, 1939, was 742 pounds. After 214 days of pasture, the average final weight was 993 pounds, or a gain of 251 pounds per steer. This was an average daily gain per steer of 1.47 pounds.

The same steers had been roughed in the barn from November 26, 1938, to April 25, 1939—a period of 151 days—and had gained an average of 302 pounds per steer, equivalent to an average daily gain of 2 pounds per steer. The daily ration in the barn consisted of one and a half pounds of shelled corn, twenty pounds of grass and legume ensilage. and ten pounds of cut dry hay—each item of which was grown and prepared on the farm referred to.

The steers came off pasture this fall looking sleek, fat and prime in every way. An average daily gain on grass pasture alone of 1.47 pounds per day for common steers compares favorably with gains reported from other parts of the country, and this growth on grass alone is the most economical gain possible. In Virginia the State and Federal authorities cooperated in a test to compare grass-fed with grain-fed beef. The grass-fed steers made a net gain in a given time of 344 pounds as against a net gain of 319 pounds for the grain-fed animals.

In the case of my steers the results were obtained on run-down land on which we have not yet built up a sufficient reserve of minerals to prevent a complete lack of these minerals in the soil at the end of the grazing period last autumn. This lack was shown in soil tests made within the past three weeks. This is, of course, reasonable and to be expected, since the minerals required for the gain reported were taken from the soil and used in building up the animals' bodies. The steers, of course, followed the horses in the pastures.

In Conclusion

I have tried to emphasize these things: the importance of improved pastures in the farm program; that all green grass is not pasture; that most permanent pastures in the eastern half of our country are not good enough to support quality livestock on a profitable production basis; that pasture to be effective must supply the grazing animal with those minerals necessary for vigorous, healthy growth which nature provided the buffalo on our virgin soils; that animals will always show a preference for well fertilized herbage.

We hear a great deal of discussion today from many sources about the need of restoring and increasing *National Income*. This is important and most desirable, of course. However, to provide a permanent income from any project it is necessary to maintain our capital intact. *Fertile soil is the basic capital of any country.* I feel that permanent national income starts with a nation's richest treasure, its natural resources; and the greatest of these of any nation is the soils of its agricultural sections. To restore and increase our National Income let us look to our *National Capital*—the fertility of our soils—and by improving our permanent pastures and balancing our farm programs by carrying more livestock per acre we can convert the soil depleting practices of our forefathers into a soil building program that will restore both Capital and Income.

BUYERS' GUIDE

A CLASSIFIED INDEX TO ALL THE ADVERTISERS IN "THE AMERICAN FERTILIZER"

This list contains representative concerns in the Commercial Fertilizer Industry, Including fertilizer manufacturers, machinery and equipment manufacturers, dealers in and manufacturers of commercial fertilizer materials and supplies, brokers, chemists, etc.
For Alphabetical List of Advertisers, see page 33.

ACID BRICK
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Chemical Construction Corp., New York City.

ACID EGGS
Chemical Construction Corp., New York City.

ACIDULATING UNITS
Chemical Construction Corp., New York City.
Sackett & Sons Co., The A. J., Baltimore, Md.

AMMO-PHOS
American Cyanamid Co., New York City.

AMMONIA—Anhydrous
Barrett Company, The, New York City.
Du Pont de Nemours & Co., E. I., Wilmington, Del.
Hydrocarbon Products Co., New York City.

AMMONIA LIQUOR
Barrett Company, The, New York City.
Du Pont de Nemours & Co., E. I., Wilmington, Del.
Hydrocarbon Products Co., New York City.

AMMONIA OXIDATION UNITS
Chemical Construction Corp., New York City.

AMMONIATING EQUIPMENT
Sackett & Sons Co., The A. J., Baltimore, Md.

APPARATUS—Laboratory
Sturtevant Mill Co., Boston, Mass.

AUTOMATIC ELEVATOR TAKEUPS
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

BABBITT
Sackett & Sons Co., The A. J., Baltimore, Md.

BAGS AND BAGGING—Manufacturers
Bagpak, Inc., New York City.
Bemis Bro. Bag Co., St. Louis, Mo.

BAGS—Cotton
Bemis Bro. Bag Co., St. Louis, Mo.

BAGS—Paper
Bagpak, Inc., New York City.
Bemis Bro. Bag Co., St. Louis, Mo.

BAGS (Waterproof)—Manufacturers
Bemis Bro. Bag Co., St. Louis, Mo.

BAGS—Dealers and Brokers
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Huber & Company, New York City.
Jett, Joseph C., Norfolk, Va.
Taylor, Henry L., Wilmington, N. C.
Wellmann, William E., Baltimore, Md.

BAGGING MACHINES—For Filling Sacks
Atlanta Utility Works, East Point, Ga.
Bagpak, Inc., New York City.
Sackett & Sons Co., The A. J., Baltimore, Md.
Sturtevant Mill Co., Boston, Mass.

BAG-CLOSING MACHINES
Bagpak, Inc., New York City.

BAG PILERS
Link-Belt Company, Philadelphia, Chicago.

BEARINGS
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

BELT LACING
Sackett & Sons Co., The A. J., Baltimore, Md.

BELTING—Chain
Atlanta Utility Works, East Point, Ga.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.
Sturtevant Mill Co., Boston, Mass.

BELTING—Leather, Rubber, Canvas
Sackett & Sons Co., The A. J., Baltimore, Md.
Sturtevant Mill Co., Boston, Mass.

BOILERS—Steam
Atlanta Utility Works, East Point, Ga.

BONE BLACK
American Agricultural Chemical Co., New York City.
Armour Fertilizer Work, Atlanta, Ga.
Huber & Company, New York City.

BONE PRODUCTS
American Agricultural Chemical Co., New York City.
Armour Fertilizer Work, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
Jett, Joseph C., Norfolk, Va.
Schmaltz, Jos. H., Chicago, Ill.
Wellmann, William E., Baltimore, Md.

BORAX AND BORIC ACID
American Potash and Chem. Corp., New York City.
Pacific Coast Borax Co., New York City.

BROKERS
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Burns & Company, L. D., Atlanta, Ga.
Huber & Company, New York City.
Jett, Joseph C., Norfolk, Va.
Keim, Samuel L., Philadelphia, Pa.
Schmaltz, Jos. H., Chicago, Ill.
Taylor, Henry L., Wilmington, N. C.
Wellmann, William E., Baltimore, Md.

BUCKETS—Elevator
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

A Classified Index to Advertisers in "The American Fertilizer"

BUYERS' GUIDE

For an Alphabetical List of all the Advertisers, see page 33

BUCKETS—For Hoists, Cranes, etc., Clam Shell, Orange Peel, Drag line, Special; Electrically Operated and Multi Power
Hayward Company, The, New York City.
Link-Belt Company, Philadelphia, Chicago.

BURNERS—Sulphur
Chemical Construction Corp., New York City.

BURNERS—Oil
Monarch Mfg. Works, Inc., Philadelphia, Pa.
Sackett & Sons Co., The A. J., Baltimore, Md.

CABLEWAYS
Hayward Company, The, New York City.

CALCIUM-NITRATE
Synthetic Nitrogen Products Co., New York City.

CAL-NITRO
Synthetic Nitrogen Products Co., New York City.

CARBONATE OF AMMONIA
American Agricultural Chemical Co., New York City.
Du Pont de Nemours & Co., E. I., Wilmington, Del.

CARS—For Moving Materials
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

CARTS—Fertilizer, Standard and Roller Bearing
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.

CASTINGS—Acid Resisting
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.

CASTINGS—Iron and Steel
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

CEMENT—Acid-Proof
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Chemical Construction Corp., New York City.

CHAIN DRIVES—Silent
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

CHAINS AND SPROCKETS
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

CHAMBERS—Acid
Chemical Construction Corp., New York City.
Fairlie, Andrew M., Atlanta, Ga.

CHEMICAL APPARATUS
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Monarch Mfg. Works, Inc., Philadelphia, Pa.

CHEMICALS
American Agricultural Chemical Co., New York City.
American Cyanamid Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Barrett Company, The, New York City.
Bradley & Baker, New York City.
Du Pont de Nemours & Co., E. I., Wilmington, Del.

CHEMICALS—Continued
Huber & Company, New York City.
Wellmann, William E., Baltimore, Md.

CHEMICAL PLANT CONSTRUCTION
Atlanta Utility Works, East Point, Ga.
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Chemical Construction Corp., New York City.
Fairlie, Andrew M., Atlanta, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.
Sturtevant Mill Co., Boston, Mass.

CHEMISTS AND ASSAYERS
Gascoyne & Co., Baltimore, Md.
Shuey & Co., Savannah, Ga.
Stillwell & Gladding, New York City.
Wiley & Company, Baltimore, Md.

CLUTCHES
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

CONCENTRATORS—Sulphuric Acid
Chemical Construction Corp., New York City.
Fairlie, Andrew M., Atlanta, Ga.

CONDITIONERS AND FILLERS
American Limestone Co., Knoxville, Tenn.

CONTACT ACID PLANTS
Chemical Construction Corp., New York City.

COPPER SULPHATE
Tennessee Corporation, Atlanta, Ga.

COTTONSEED PRODUCTS
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
Jett, Joseph C., Norfolk, Va.
Schmaltz, Jos. H., Chicago, Ill.
Taylor, Henry L., Wilmington, N. C.
Wellmann, William E., Baltimore, Md.

CRANES AND DERRICKS
Hayward Company, The, New York City.
Link-Belt Company, Philadelphia, Chicago.
Link-Belt Speeder Corp., Chicago, Ill. and Cedar Rapids, Iowa.
Sackett & Sons Co., The A. J., Baltimore, Md.

CYANAMID
American Agricultural Chemical Co., New York City.
American Cyanamid Co., New York City.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Jett, Joseph C., Norfolk, Va.
Taylor, Henry L., Wilmington, N. C.
Wellmann, William E., Baltimore, Md.

DENS—Superphosphate
Chemical Construction Corp., New York City.
Stedman's Foundry and Mach. Works, Aurora, Ind.
Sturtevant Mill Co., Boston, Mass.

A Classified Index to Advertisers in "The American Fertilizer"

BUYERS' GUIDE

For an Alphabetical List of all the Advertisers, see page 33

DISINTEGRATORS
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

DOUBLE SUPERPHOSPHATE (See Superphosphate—Concentrated)

DRYERS—Direct Heat
Sackett & Sons Co., The A. J., Baltimore, Md.

DRIVES—Electric
Link-Belt Company, Philadelphia, Chicago.

DUMP CARS
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

DUST COLLECTING SYSTEMS
Sackett & Sons Co., The A. J., Baltimore, Md.
Sturtevant Mill Co., Boston, Mass.

ELECTRIC MOTORS AND APPLIANCES
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.

ELEVATORS
Atlanta Utility Works, East Point, Ga.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

ELEVATORS AND CONVEYORS—Portable
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Sturtevant Mill Co., Boston, Mass.

ENGINEERS—Chemical and Industrial
Chemical Construction Corp., New York City.
Fairlie, Andrew M., Atlanta, Ga.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.
Sturtevant Mill Co., Boston, Mass.

ENGINES—Steam
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.

EXCAVATORS AND DREDGES—Drag Line and Cableway
Hayward Company, The, New York City.
Link-Belt Company, Philadelphia, Chicago.
Link-Belt Speeder Corp., Chicago, Ill. and Cedar Rapids, Iowa.

FERTILIZER MANUFACTURERS
American Agricultural Chemical Co., New York City.
American Cyanamid Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Farmers Fertilizer Co., Columbus, Ohio.
International Agricultural Corp., New York City.
Smith-Rowland Co., Norfolk, Va.
U. S. Phosphoric Products Corp., New York City.

FISH SCRAP AND OIL
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
Jett, Joseph C., Norfolk, Va.
Taylor, Henry L., Wilmington, N. C.
Wellmann, William E., Baltimore, Md.

FOUNDERS AND MACHINISTS
Atlanta Utility Works, East Point, Ga.
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Link-Belt Company, Philadelphia, Chicago.

FOUNDERS AND MACHINISTS—Continued
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

GARBAGE TANKAGE
Wellmann, William E., Baltimore, Md.

GEARS—Machine Moulded and Cut
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

GEARS—Silent
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

GELATINE AND GLUE
American Agricultural Chemical Co., New York City.

GUANO
Baker & Bro., H. J., New York City.

HOISTS—Electric, Floor and Cage Operated, Portable
Hayward Company, The, New York City.

HOPPERS
Atlanta Utility Works, East Point, Ga.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.
Sturtevant Mill Co., Boston, Mass.

IMPORTERS, EXPORTERS
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Wellmann, William E., Baltimore, Md.

IRON SULPHATE
Tennessee Corporation, Atlanta, Ga.

INSECTICIDES
American Agricultural Chemical Co., New York City.

LACING—Belt
Sackett & Sons Co., The A. J., Baltimore, Md.

LIMESTONE
American Agricultural Chemical Co., New York City.
American Limestone Co., Knoxville, Tenn.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Wellmann, William E., Baltimore, Md.

LOADERS—Car and Wagon, for Fertilizers
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

MACHINERY—Acid Making
Atlanta Utility Works, East Point, Ga.
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Chemical Construction Corp., New York City.
Fairlie, Andrew M., Atlanta, Ga.
Monarch Mfg. Works, Inc., Philadelphia, Pa.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.
Sturtevant Mill Co., Boston, Mass.

MACHINERY—Coal and Ash Handling
Hayward Company, The, New York City.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

MACHINERY—Elevating and Conveying
Atlanta Utility Works, East Point, Ga.
Hayward Company, The, New York City.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.
Sturtevant Mill Co., Boston, Mass.

A Classified Index to Advertisers in "The American Fertilizer"

BUYERS' GUIDE

For an Alphabetical List of all the Advertisers, see page 33

MACHINERY—Grinding and Pulverizing
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.
Sturtevant Mill Co., Boston, Mass.

MACHINERY—Power Transmission
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.
Sturtevant Mill Co., Boston, Mass.

MACHINERY—Pumping
Atlanta Utility Works, East Point, Ga.

MACHINERY—Tankage and Fish Scrap
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.
Sturtevant Mill Co., Boston, Mass.

MAGNETS
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

MANGANESE SULPHATE AND CARBONATE
Tennessee Corporation, Atlanta, Ga.

MANGANESE SULPHATE
Tennessee Corportion, Atlanta, Ga.

MIXERS
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.
Sturtevant Mill Co., Boston, Mass.

NITRATE OF SODA
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Barrett Company, The, New York City.
Bradley & Baker, New York City.
Chilean Nitrate Sales Corp., New York City.
Huber & Company, New York City.
International Agricultural Corp., New York City.
Schmaltz, Jos. H., Chicago, Ill.
Wellmann, William E., Baltimore, Md.

NITRATE OVENS AND APPARATUS
Chemical Construction Corp., New York City.

NITROGENOUS ORGANIC MATERIAL
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Du Pont de Nemours & Co., E. I., Wilmington, Del.
Huber & Company, New York City.
International Agricultural Corp., New York City.
Smith-Rowland Co., Norfolk, Va.
Wellmann, William E., Baltimore, Md.

NOZZLES—Spray
Monarch Mfg. Works, Inc., Philadelphia, Pa.

PACKING—For Acid Towers
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Chemical Construction Corp., New York City.

PANS AND POTS
Stedman's Foundry and Mach. Works, Aurora, Ind.

PHOSPHATE MINING PLANTS
Chemical Construction Corp., New York City.

PHOSPHATE ROCK
American Agricultural Chemical Co., New York City.
American Cyanamid Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Charleston Mining Co., Inc., Richmond, Va.
Huber & Company, New York City.
International Agricultural Corp., New York City.
Jett, Joseph C., Norfolk, Va.
Ruhm, H. D., Mount Pleasant, Tenn.
Schmaltz, Jos. H., Chicago, Ill.
Southern Phosphate Corp., Baltimore, Md.
Taylor, Henry L., Wilmington, Del.
Wellmann, William E., Baltimore, Md.

PIPES—Chemical Stoneware
Chemical Construction Corp., New York City.

PIPES—Wooden
Stedman's Foundry and Mach. Works, Aurora, Ind.

PLANT CONSTRUCTION—Fertilizer and Acid
Chemical Construction Corp., New York City.
Fairlie, Andrew M., Atlanta, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.

POTASH SALTS—Dealers and Brokers
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
International Agricultural Corp., New York City.
Jett, Joseph C., Norfolk, Va.
Schmaltz, Jos. H., Chicago, Ill.
Synthetic Nitrogen Products Co., New York City.
Taylor, Henry L., Wilmington, Del.
Wellmann, William E., Baltimore, Md.

POTASH SALTS—Manufacturers and Importers
American Potash and Chem. Corp., New York City.
Potash Co. of America, Baltimore, Md.
United States Potash Co., New York City.

PULLEYS AND HANGERS
Atlanta Utility Works, East Point, Ga.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.
Sturtevant Mill Co., Boston, Mass.

PUMPS—Acid-Resisting
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Monarch Mfg. Works, Inc., Philadelphia, Pa.

PYRITES—Brokers
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Jett, Joseph C., Norfolk, Va.
Wellmann, William E., Baltimore, Md.

QUARTZ
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.

RINGS—Sulphuric Acid Tower
Chemical Construction Corp., New York City.

A Classified Index to Advertisers in "The American Fertilizer"

BUYERS' GUIDE

For an Alphabetical List of all the Advertisers, see page 33

ROUGH AMMONIATES
Bradley & Baker, New York City.
Schmaltz, Jos. H., Chicago, Ill.
Wellmann, William E., Baltimore, Md.

SCALES—Including Automatic Bagging
Atlanta Utility Works, East Point, Ga.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

SCRAPERS—Drag
Hayward Company, The, New York City.
Link-Belt Company, Philadelphia, Chicago.

SCREENS
Atlanta Utility Works, East Point, Ga.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.
Sturtevant Mill Co., Boston, Mass.

SEPARATORS—Air
Sackett & Sons Co., The A. J., Baltimore, Md.
Sturtevant Mill Co., Boston, Mass.

SEPARATORS—Including Vibrating
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Sturtevant Mill Co., Boston, Mass.

SEPARATORS—Magnetic
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

SHAFTING
Atlanta Utility Works, East Point, Ga.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.
Stedman's Foundry and Mach. Works, Aurora, Ind.

SHOVELS—Power
Link-Belt Company, Philadelphia, Chicago.
Link-Belt Speeder Corp., Chicago, Ill. and Cedar Rapids, Iowa.
Sackett & Sons Co., The A. J., Baltimore, Md.

SPRAYS—Acid Chambers
Monarch Mfg. Works, Inc., Philadelphia, Pa.

SPROCKET WHEELS (See Chains and Sprockets)

STACKS
Sackett & Sons Co., The A. J., Baltimore, Md.

SULPHATE OF AMMONIA
American Agricultural Chemical Co., New York City
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Barrett Company, The, New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
Hydrocarbon Products Co., New York City.
Jett, Joseph C., Norfolk, Va.
Schmaltz, Jos. H., Chicago, Ill.
Snythetic Nitrogen Products Co., New York City.
Taylor, Henry L., Wilmington, N. C.
Wellmann, William E., Baltimore, Md.

SULPHUR
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Texas Gulf Sulphur Co., New York City.

SULPHURIC ACID
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.

SULPHURIC ACID—Continued
Bradley & Baker, New York City.
Huber & Company, New York City.
Jett, Joseph C., Norfolk, Va.
Taylor, Henry L., Wilmington, N. C.
U. S. Phosphoric Products Corp., New York City.
Wellmann, William E., Baltimore, Md.

SUPERPHOSPHATE
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
Huber & Company, New York City.
International Agricultural Corp., New York City.
Jett, Joseph C., Norfolk, Va.
Schmaltz, Jos. H., Chicago, Ill.
Taylor, Henry L., Wilmington, N. C.
U. S. Phosphoric Products Corp., New York City.
Wellmann, William E., Baltimore, Md.

SUPERPHOSPHATE—Concentrated
Armour Fertilizer Works, Atlanta, Ga.
International Agricultural Corp., New York City.
U. S. Phosphoric Products Corp., New York City.

SYPHONS—For Acid
Monarch Mfg. Works, Inc., Philadelphia, Pa.

TALLOW AND GREASE
American Agricultural Chemical Co., New York City.

TANKAGE
American Agricultural Chemical Co., New York City.
Armour Fertilizer Works, Atlanta, Ga.
Ashcraft-Wilkinson Co., Atlanta, Ga.
Baker & Bro., H. J., New York City.
Bradley & Baker, New York City.
International Agricultural Corp., New York City.
Jett, Joseph C., Norfolk, Va.
Schmaltz, Jos. H., Chicago, Ill.
Smith-Rowland Co., Norfolk, Va.
Taylor, Henry L., Wilmington, N. C.
Wellmann, William E., Baltimore, Md.

TANKAGE—Garbage
Huber & Company, New York City.

TANKS
Sackett & Sons Co., The A. J., Baltimore, Md.

TILE—Acid-Proof
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.

TOWERS—Acid and Absorption
Chemical Construction Corp., New York City.
Fairlie, Andrew M., Atlanta, Ga.

UNLOADERS—Car and Boat
Hayward Company, The, New York City.
Link-Belt Company, Philadelphia, Chicago.
Sackett & Sons Co., The A. J., Baltimore, Md.

UREA
Du Pont de Nemours & Co., E. I., Wilmington, Del.
Snythetic Nitrogen Products Co., New York City.

UREA-AMMONIA LIQUOR
Du Pont de Nemours & Co., E. I., Wilmington, Del.

VALVES—Acid-Resisting
Atlanta Utility Works, East Point, Ga.
Charlotte Chem. Laboratories, Inc., Charlotte, N. C.
Monarch Mfg. Works, Inc., Philadelphia, Pa.

WHEELBARROWS (See Carts)

ZINC SULPHATE
Tennessee Corporation, Atlanta, Ga.

ALPHABETICAL LIST OF ADVERTISERS

For Classified Index, see pages 28 to 32, inclusive

American Agricultural Chemical Co., New York City 16
American Cyanamid Co., New York City.. 3
American Limestone Co., Knoxville, Tenn..18
American Potash and Chemical Corp., New York City 4, 25
Armour Fertilizer Works, Atlanta, Ga.....—
Ashcraft-Wilkinson Co., Atlanta, Ga. 4
Atlanta Utility Works, East Point, Ga. 34

Bagpak, Inc., New York City .....—
Baker & Bro., H. J., New York City, Front cover, 20
Barrett Company, The, New York City, Back cover
Bemis Bro., Bag Company, St. Louis, Mo.—
Blakiston's Son & Co., P., Philadelphia, Pa. —
Bradley & Baker, New York City.....14
Burns & Company, L. D., Atlanta, Ga.....—

Charleston Mining Co., Inc., Richmond, Va. —
Charlotte Chemical Lab., Charlotte, N. C. ..—
Chemical Construction Corp., New York City .....—
Chilean Nitrate Sales Corp., New York City —

Dougherty, Jr., E., Philadelphia, Pa. 33
DuPont de Nemours & Co., E. I., Wilmington, Del. 21
Duriron Company, Dayton, Ohio .....—

Fairlie, Andrew M., Atlanta, Ga. 29
Farmers Fertilizer Co., Columbus, Ohio 34
Flexible Steel Lacing Co., Chicago, Ill. ....—
Fulton Bag & Cotton Mills, Atlanta, Ga. ...—

Gascoyne & Co., Inc., Baltimore, Md. 34

Hayward Company, The, New York City ..34
Huber Company, L. W., New York City..—
Hydrocarbon Products Co., New York City 17

International Agricultural Corporation, New York City .....2d cover

Jeffrey Mfg. Co., Columbus, Ohio .....—
Jett, Joseph C., Norfolk, Va. 34

Keim, Samuel D., Philadelphia, Pa. 33

Link-Belt Company, Chicago, Ill.....—

Monarch Mfg. Works, Inc., Philadelphia, Pa. 34

Pacific Coast Borax Co., New York City...23
Polk Co., R. L., Detroit, Mich. .....—
Potash Co. of America, Baltimore, Md., 3d cover
Ransome Concrete Machinery Co., Dunellen, N. J. .....—
Ruhm, H. D., Columbia, Tenn. 34

Sackett & Sons Co., The A. J., Baltimore, Md. 24
Schmaltz, Jos. H., Chicago, Ill.....26
Shuey & Co., Savannah, Ga. 34
Smith-Rowland Co., Norfolk, Va. .....—
Southern Phosphate Corp., Baltimore, Md. —
Stedman's Foundry and Machine Works, Aurora, Ind. 22
Stillwell & Gladding, New York City 34
Sturtevant Mill Co., Boston, Mass. .....—
Synthetic Nitrogen Products Co., New York City 23

Taylor, Henry L., Wilmington, N. C. 28
Tennessee Corporation, Atlanta, Ga.....25
Texas Gulf Sulphur Co., New York City..—

U. S. Phosphoric Products Corp., New York City 23
United States Potash Co., New York City 19

Wellmann, William E., Baltimore, Md.....25
Wiley & Company, Inc., Baltimore, Md. 34

A QUICK CURE

THE MANUFACTURER who finds he has underestimated his fertilizer sales prospects and is short of cured base is fortunate if he holds a contract for *Barrett's* NITROGEN SOLUTIONS.

BECAUSE:—

325 pounds of *Barrett's* NITROGEN SOLUTION IV added to 1,675 pounds of Superphosphate will produce a base which will analyze about 6-16-0 and which, after a short curing period, can be used in formulating a wide range of complete mixtures of acceptable physical properties for prompt use.

Let our Technical Service Bureau advise you regarding emergency mixtures made with *Barrett's* NITROGEN SOLUTIONS and *Domestic* SULPHATE OF AMMONIA.

THE BARRETT COMPANY

NEW YORK, N. Y.

HOPEWELL, VA. — MONTGOMERY, ALA.
RALEIGH, N. C. — NEW ORLEANS, LA.
COLUMBIA, S. C. — MEMPHIS, TENN.
ATLANTA, GA. — SAN FRANCISCO, CAL.

Barrett's NITROGEN

HEADQUARTERS FOR NITROGEN